

# Is there a link between macronutrient intake and prostate cancer?

**Original article** Bidoli E *et al.* (2005) Macronutrients, fatty acids, cholesterol and prostate cancer risk. *Ann Oncol* 16: 152–157

## SYNOPSIS

**KEYWORDS** diet, fatty acids, macronutrients, prostate cancer, starch

## BACKGROUND

It has been suggested that there is a link between dietary intake of certain macronutrients and the risk of prostate cancer. Until now, the majority of studies in this area have focused on the relationship between fat consumption and the disease, with variable results, and very little is known about the effects of carbohydrates, cholesterol and proteins on prostate cancer risk.

## OBJECTIVES

To examine the association between the risk of prostate cancer and dietary intake of six macronutrients: proteins, sugars, starch, cholesterol, monounsaturated and polyunsaturated fatty acids; in a sample of Italian men.

## DESIGN AND INTERVENTION

This large, case-control study recruited cases and control patients that had been admitted to hospitals in five Italian provinces between 1991 and 2002. All cases were admitted with incident, histologically confirmed prostate cancer and the controls presented with a variety of other conditions unrelated to malignancy, digestive disease or any illness linked to diet. Clinical staff used a food frequency questionnaire to obtain information on the participants' dietary intake of 78 food categories for which macronutrient levels had been defined. Demographic data were also obtained. Unconditional multiple logistic regression models were used to determine odds ratios (OR) and 95% confidence intervals (CI) for quintiles of increasing nutrient levels compared with the lowest quintile.

## OUTCOME MEASURES

Primary endpoints were effects of macronutrients, sources and types of dietary fat and specific fatty acids on prostate cancer risk. Age, BMI and family history were also assessed.

## RESULTS

Case and control groups comprised 1,294 men (46–74 years old, median 66) and 1,451 men (46–74 years old, median 63), respectively. Less than 5% of participants declined to be interviewed. The risk of prostate cancer was significantly greater in those with a high starch intake ( $OR=1.4$ ; 95% CI 1.1–1.8), and polyunsaturated fats were associated with low prostate cancer risk ( $OR=0.8$ ; 95% CI 0.6–1.0), although this result was not significant. Of the fatty acids measured, only linolenic acid was significantly related to a decreased risk of prostate cancer ( $OR=0.7$ ; 95% CI 0.6–0.9). Prostate cancer risk was not affected by cholesterol intake. The significant correlation between high levels of starch and increased prostate cancer risk persisted when all six nutrients were analysed in the same model ( $OR=1.07$ ; 95% CI 1.02–1.13), and a significant inverse relationship was detected for polyunsaturated fatty acids ( $OR=0.84$ ; 95% CI 0.72–0.98). In addition, this model indicated that monounsaturated fatty acid intake was significantly associated with increased risk ( $OR=1.11$ ; 95% CI 1.03–1.20). No relationship was found for proteins, sugars, saturated fats or cholesterol.

## CONCLUSION

In this sample of Italian men, intake of monounsaturated fatty acids and starch was directly related to an increased risk of prostate cancer. Polyunsaturated fatty acid consumption was associated with a significantly lower risk of the disease.

## COMMENTARY

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Despite considerable research on diet and prostate cancer, overall findings from previous investigations have proven inconclusive. The large, hospital-based, case-control study from Italy by Bidoli *et al.* helps to address this issue by examining macronutrients, sources and types of dietary fat, and specific fatty acids in relation to prostate cancer risk.

The main result was that dietary starch intake was associated with an increased risk of prostate cancer. Although dietary glycemic load was not evaluated, this finding, if confirmed in prospective studies, has potentially significant public health implications. It suggests that high intake of carbohydrate-rich foods, such as pasta, potatoes, rice, and bread, may increase prostate cancer risk. Possible biological mechanisms linking high intake of rapidly absorbed carbohydrates to increased risk of prostate cancer include hyperinsulinemia<sup>1</sup> and chronic inflammation.<sup>2</sup>

A modest increase in prostate cancer risk was also observed with increased monounsaturated fatty acid intake, which is puzzling because olive oil is the major source of monounsaturated fat in Mediterranean diets, and prostate cancer mortality rates have traditionally been low in areas with high olive oil consumption. However, animal products such as meat and dairy foods do contribute to the total monounsaturated fatty acid intake in Italian diets. A presentation of the separate contributions of monounsaturated fat from animal and vegetable sources may have indicated whether animal-derived monounsaturated fat intake masked a potentially protective effect of olive oil-derived monounsaturated fat intake in the present study. In addition, the monounsaturated fatty acid result in the fully partitioned statistical model may have been confounded by total energy intake.

High polyunsaturated fatty acid intake was associated with decreased prostate cancer risk, which was primarily due to linoleic acid and alpha-linolenic acid, the two principal fatty acids in this group. Most previous epidemiologic

studies that have examined linoleic acid indicate no association with prostate cancer.<sup>3</sup> In contrast, numerous previous investigations have reported an increased prostate cancer risk with high alpha-linolenic acid intake.<sup>4</sup> The inverse relationships of both linoleic and alpha-linolenic acid with prostate cancer in the present study may have been partly attributable to favorable dietary components associated with vegetable oil use, such as vitamin E and lycopene, which were unaccounted for in the analysis. Rather surprisingly, intakes of polyunsaturated fatty acids other than linoleic and alpha-linolenic acid (presumably the combination of eicosapentaenoic and docosahexaenoic acid) were related to increased risk of prostate cancer. Whether this indicates an adverse effect of fish intake on prostate cancer risk, as has been suggested by a recent prospective study from Japan,<sup>5</sup> or is due to biased recall of past fish intake among prostate cancer cases remains speculative.

The major implication of the present report is that a carbohydrate-based diet may adversely affect prostate cancer risk. Prospective observational and directed studies are needed to confirm this finding and to uncover the biological mechanisms involved. Additional work is required to examine the associations with animal versus vegetable sources of monounsaturated fat and to further clarify the relations of individual polyunsaturated fatty acids to prostate cancer risk, in particular to advanced prostate cancer risk.

## References

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**Competing interests**  
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**PRACTICE POINT**  
A diet high in starch may increase the risk of developing prostate cancer, and additional research is needed to evaluate the role of dietary intake of simple versus complex carbohydrates